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WORK PLAN TO REMEDIATE SOILS AND INVESTIGATE GROUNDWATER IMPACTED BY VOLATILE ORGANIC COMPOUNDS AT MONADNOCK COMPANY FACILITY IN CITY OF INDUSTRY, CALIFORNIA

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1.0 INTRODUCTION

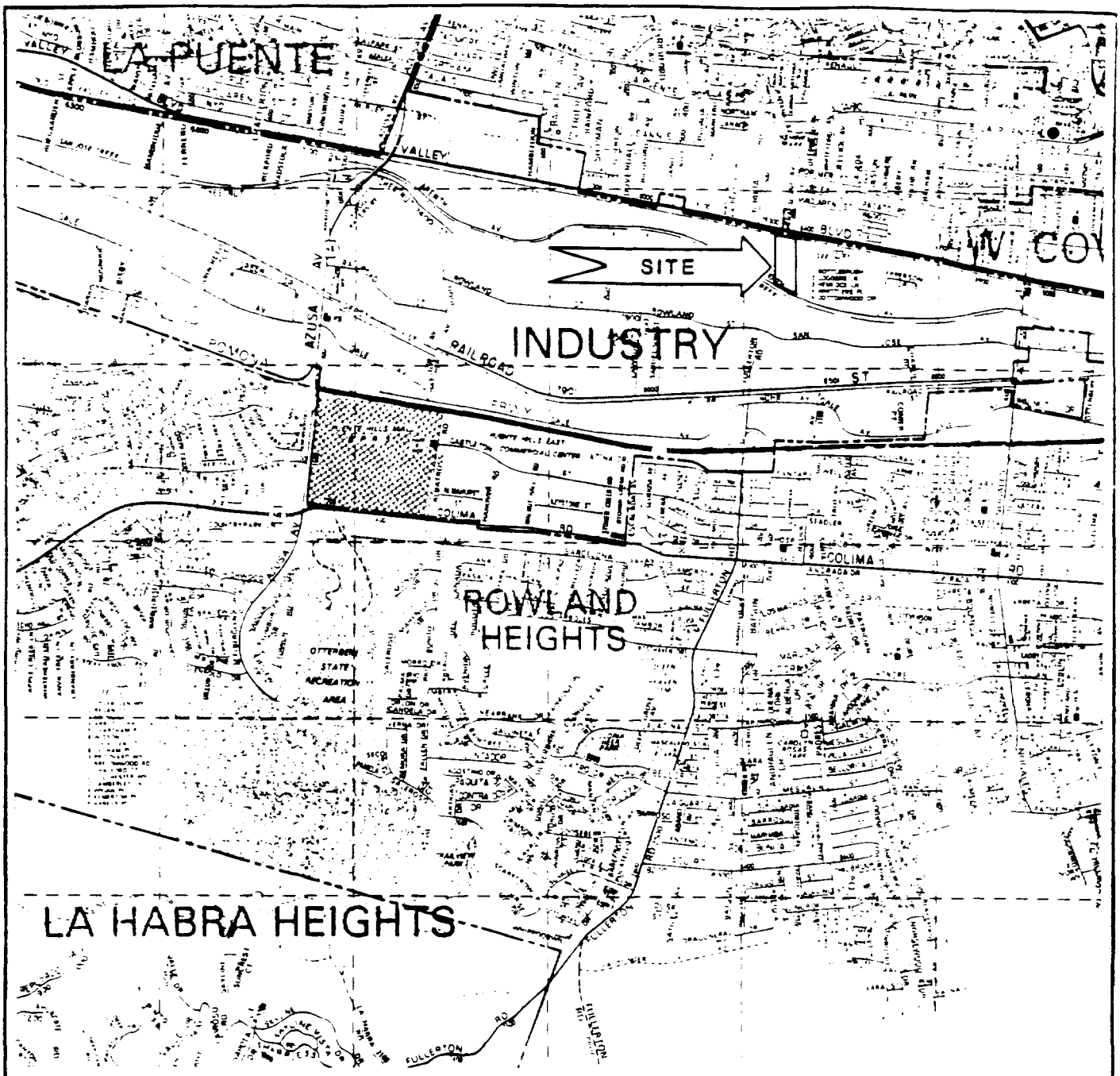
TRW Inc. (TRW), as a condition of the amended Cleanup and Abatement Order 88-057 (dated September 29, 1989) issued by the California Regional Water Quality Control Board - Los Angeles Region (RWQCB), is required to "determine any other contamination sources in the vadose zone on site (at the Monadnock Company facility) and evaluate threat to groundwater from residual contamination." To accomplish this goal, TRW used a phased approach, whereby (1) potential sources of contamination in the vadose zone were identified (Phase 2A) and (2) after identifying the potential sources of contamination, the lateral and vertical extent of contamination was evaluated (Phase 2B).

As a result of the Phase 2A and Phase 2B soil investigations, it was concluded by TRW and the RWQCB that remediation of soils containing volatile organic compounds (VOCs) is required at the Monadnock Company facility (see Figure 1 for site location). In addition, because underlying groundwater potentially could have been impacted by the VOCs in the soil, further groundwater investigation is planned. This work plan summarizes the activities that will be undertaken to accomplish these tasks.

2.0 REMEDIATION OF VOC-CONTAINING SOIL

Based on the historical uses of the site, the locations of potential pathways (underground structures, piping, drains) for VOCs to impact subsurface soils, and the analytical data generated during the Phase 2A and Phase 2B soil investigations, it was concluded that VOCs have impacted subsurface soils at the Monadnock Company site. During the Phase 2A soil investigation conducted in 1990, Woodward-Clyde Consultants identified the following areas at the Monadnock Company facility that contained VOCs in soil gas:

- Sewer line and area adjacent to Monitoring Well MW-3
- Southwest corner of building and alleged former swamp area
- Southeast corner of building and bermed area along east wall of building
- Degreaser area inside building
- Pavement line south of building



SITE LOCATION

Project No.:	Date: SEPT 1988	Project: TRW-MONADNOCK	Fig. 1

Additional soil gas work conducted by ID Environmental Associates, Inc. (IDEA) during Phase 2B in 1991 confirmed the findings of the Phase 2A investigation.

The data from the Phase 2A and Phase 2B soil gas surveys indicated that much of the VOC-containing soil gas beneath the Monadnock Company property probably has resulted from gas migration, rather than VOCs being present in the soil matrix. Areas apparently impacted by migrating VOC-containing soil gas include the heat treatment room, the sewer line and area adjacent to Monitoring Well MW-3, the southwest corner of the building and the alleged former swamp area, the southeast corner of the building, and the pavement line south of the building.

To confirm that elevated VOC concentrations in soil gas were the result of migrating soil gas and not VOCs present in the soil matrix, IDEA drilled soil borings in each area containing elevated concentrations of VOCs in soil gas. Soil samples were collected from each boring and analyzed for purgeable halogenated volatile organics (EPA Method 8010) or VOCs (EPA Method 8260). Significant concentrations of VOCs [in the hundreds and low thousands of micrograms of compound per kilogram of soil (μg/kg)] were only detected in the subsurface soil matrix beneath the degreaser area. Insignificant concentrations of VOCs (in the low tens of μg/kg or less) were detected in other areas at the site.

2.1 Vapor Extraction System

To remediate elevated VOC concentrations in both soil gas and the soil matrix, a vapor extraction system (VES) will be used at the Monadnock Company site.

The VES will consist of the following components:

- Vapor extraction wells, each of 4-inch diameter
- Pressure monitor wells of 2-inch diameter
- One 5-horsepower blower and motor (size pending results of pilot test)
- Air emissions control unit
- Related piping and gauges

Through the use of the blower, a vacuum (less than atmospheric pressure) will be maintained on the extraction well(s). Because a pressure differential will exist between the extraction well(s) and the surrounding soil, air will flow through the VOC-impacted soil toward the well(s). Compounds with a measurable vapor pressure will then be stripped from the soil by the moving air. These compounds will be collected at the extraction well(s) and discharged to the atmosphere through the air emissions control unit.

The pressure monitor wells will be used to evaluate certain system performance characteristics. Pressures will be monitored at 5, 15, and 25 feet of depth within each of the wells. These data will be used to evaluate soil gas flow patterns within the zone of impacted soil, thus documenting that these soils are being influenced by the VES. In addition, the pressure monitor wells will be used to measure real-time concentrations of VOCs in soil gas, thus documenting that elevated VOC concentrations in soil gas are being remediated.

2.1.1 Design Requirements

Soil remediation at the Monadnock Company site will be conducted on a phased basis, occurring first in the degreaser area. Following completion of soil remediation in the degreaser area, the VES unit will be moved to the sewer line/Monitoring Well MW-3 area, and soil remediation begun in that area. This sequence will be repeated until all areas requiring soil remediation have been treated.

Vapor extraction and pressure monitor wells will be installed in all areas at one time. Proposed locations are shown on Figure 2. Well installation will occur as follows:

- **Degreaser area** - One extraction well and four pressure monitor wells will be installed. One of the pressure monitor wells will be located between the degreaser area and the heat treatment room (see Figure 2) to evaluate if VOC-containing soil gas beneath the heat treatment room is being captured by the VES.

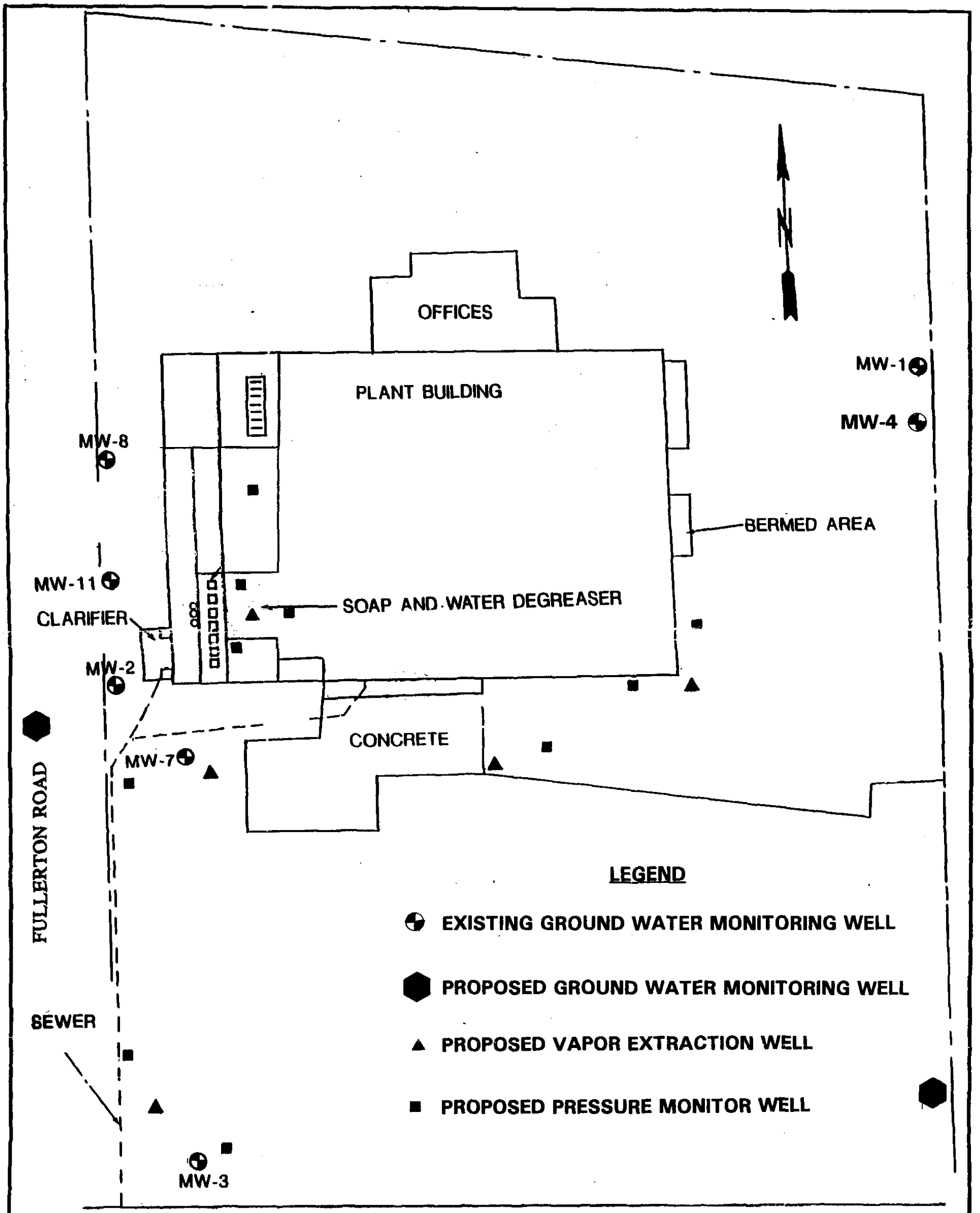
- **Sewer line and area adjacent to Monitoring Well MW-3** - One extraction well and two pressure monitor wells will be installed.

- **Southwest corner of building and alleged former swamp area** - One extraction well and one pressure monitor well will be installed.

- **Southeast corner of building and bermed area along east wall of building** - One extraction well and two pressure monitor wells will be installed.

- **Pavement line south of building** - One extraction well and one pressure monitor well will be installed.

Vapor extraction wells will be slotted from 2 to 25 feet below grade. Pressure monitor wells will consist of 1-foot slotted sections at depths of 5, 15, and 25 feet below grade. Wells will not extend to depths greater than 25 feet below grade to avoid contact with the underlying groundwater (located at 30 to 35 feet below grade).



PROPOSED LOCATIONS OF GROUND WATER MONITORING WELLS, VAPOR EXTRACTION WELLS, AND PRESSURE MONITOR WELLS

Project No.: 9104M	Date: MARCH 1992	Project: TRW - MONADNOCK	FIG. 2

To assist in sizing the VES blower and motor, a pilot test will be conducted. After installation of the vapor extraction and pressure monitor wells in the degreaser area, a portable blower and motor will be brought to and used at the Monadnock Company site to evaluate the following parameters:

- o Range of flow rates of extracted soil gas from extraction wells
- o Expected organic compound concentrations in the extracted soil gas

2.1.2 Regulatory Agency Permits

Regulatory agencies that may require approvals or permits to operate the VES are the California Environmental Protection Agency - Department of Toxic Substances Control (DTSC), the South Coast Air Quality Management District (SCAQMD) and the RWQCB. Following specification of the VES equipment and air emissions control device, the necessary permit applications will be prepared for submittal to the DTSC, SCAQMD and RWQCB. These agencies may impose certain restrictions as part of their approval to operate, including:

- o Onsite monitoring of the VES at periodic intervals, with recording of the following parameters:
  - subsurface pressures and VOC concentrations at pressure monitor wells
  - velocity, temperature, and pressure of extracted soil gas stream to air emissions control unit
  - organic compound concentrations of inlet and exhaust gas streams to and from the air emissions control unit
- o Performance test of VES air emissions control unit soon after startup of equipment
- o Preparation of written documentation to establish effectiveness of the VES

2.1.3 Air Emissions Control

Based on the estimated quantity of VOCs present in the soil gas and soil matrix, it is anticipated that the air emissions control system will use carbon adsorption. The carbon adsorption system will consist of two or three canisters in series.

2.2 Soil Sampling and Analysis

It is anticipated that two soil sampling and analysis events will occur over the life of the remediation project. These events will occur at the middle and at the end of the project. Presently, it is anticipated that each event will consist of the following activities:

- Drilling of soil borings to 25 feet of depth and collection of soil samples from within each boring at 5-foot intervals.
- Analysis of collected soil samples for purgeable halogenated volatile organics using EPA Method 8010

The data from the first soil sampling and analysis event will be used to assess the on-going effectiveness of the VES. After review of the data, modifications will be made to the VES as necessary [e.g., using the pressure monitor well(s) as additional extraction well(s)]. The data from the second soil sampling and analysis event will be used to document that the soil remediation project is complete.

2.3 Preparation of Final Closure Report

Following completion of the soil remediation project, a final closure report will be prepared. The report will summarize the following topics:

- Previous soil investigation programs conducted at the site
- Soil remediation program conducted in degreaser area, sewer line and area adjacent to Monitoring Well MW-3, southwest corner of building and alleged former swamp area, southeast corner of building and bermed area along east wall of building, and pavement line south of building. Included will be a description of the VES and the results of the confirmatory analyses.

The report will include copies of the chain-of-custody forms and analytical laboratory reports relevant to the soil remediation programs.

3.0 GROUNDWATER INVESTIGATION

To evaluate if groundwater has been impacted at the Monadnock Company site, a groundwater investigation program (Phase 3) will be undertaken. The Phase 3 program will consist of (1) the installation of additional groundwater monitoring wells and (2) groundwater sampling and analysis using the existing and proposed wells.

Initially, the objective of the groundwater investigation will be to identify onsite areas at which groundwater may have been impacted by VOCs. The initial investigation will focus on the uppermost groundwater zone (located at approximately 30 to 35 feet below the ground surface). After these areas have been identified, an additional investigation will be conducted to assess the extent of VOC-impacted groundwater, both onsite and offsite.

The following subsections describe the initial groundwater investigation.

3.1 Installation of Additional Groundwater Monitoring Wells

Presently, seven groundwater monitoring wells are located on the Monadnock Company property (see Figure 2 for well locations). A recent sounding of the wells (March 11, 1992) indicates that five of the wells (Wells MW-1, MW-2, MW-4, MW-7, and MW-8) extend to between 45 and 50 feet of depth; Well MW-11 extends to a depth greater than 100 feet. Well MW-3 was inaccessible at the time of the well soundings due to the construction of Fullerton Road. Previous sampling and analysis of groundwater samples from these wells (conducted in 1989) indicated the presence of chlorinated organic compounds at concentrations ranging from the low micrograms of compound per liter of water (μg/l) to hundreds of μg/l.

The initial groundwater investigation will use the existing wells and additional wells to be installed. The additional wells will be located as follows:

- One well will be sited along the eastern fence line, near Arenth Avenue. This well, in addition to the existing Wells MW-1 and MW-4, will be used to assess the chemical quality of groundwater flowing onto the Monadnock Company site.

- One well will be sited west of the Monadnock Company property, on the Fullerton Road right-of-way (assuming that permission can be obtained from the applicable governmental agencies). This well will be used to assess if VOCs originating at the Monadnock Company site have migrated offsite.

The proposed locations of the additional wells are shown on Figure 2. Prior to installation of the additional wells, a permit will be obtained from the Los Angeles County Department of Health Services (LACDHS).

The additional wells will be constructed of 4-inch diameter PVC casing (consistent with the construction materials of the existing wells at the site). Presently, water elevations beneath the Monadnock Company site are between 30 and 35 feet below the ground surface (based on measurement of water levels in four of the existing wells conducted on March 11, 1992). Thus, the additional wells will be screened from about 20 feet to 50 feet below the ground surface, in conformance with RWQCB guidelines.

Prior to casing placement, the aquifer materials will be characterized using a sieve analysis to properly select the appropriate filter pack and screen. After placement of the casing, the filter pack will be installed to extend a minimum of two feet above the end of the screened interval. A cement or cement/bentonite grout will be used above the filter pack to approximately three feet below the ground surface. The final three feet will be completed using a cement seal. A locking cover (traffic-rated where appropriate) will be placed over the completed well.

The additional wells will be purged and developed in conformance with RWQCB guidelines. Each of the existing and additional wells will be surveyed to establish the elevation of the top of each well casing (to the nearest 0.01 foot) relative to mean sea level.

Waste water generated during well installation and development will be placed in 55-gallon drums, labeled as to well location, and left on site. Drum contents will be disposed of onsite or at an appropriate waste disposal facility, depending on the results of chemical analyses of groundwater samples collected from the wells (see Section 3.2).

3.2 Groundwater Sampling and Analysis

After installation of the additional wells, groundwater samples (one primary sample and one duplicate sample) will be collected from each of the existing and additional wells. The groundwater samples will be submitted to CKY Analytical Laboratories, a California-certified hazardous waste analytical laboratory, for chemical analysis; a field blank (used to evaluate cross-contamination of the samples during shipment) will be included with the samples. The primary samples, one duplicate sample, and the field blank will be analyzed for purgeable halocarbons using EPA Method 601.

Waste water generated during well sampling will be placed in 55-gallon drums, labeled as to well location, and left on site. Drum contents will be disposed of onsite or at an appropriate waste disposal facility, depending on the results of chemical analyses of groundwater samples collected from the wells.

3.3 Reporting

After receipt of the analytical data, a final report will be prepared and submitted to the RWQCB. The report will summarize the following topics:

- o description of regional geology and hydrogeology
- o rationale for locations of additional wells
- o well installation and development procedures
- o boring logs
- o groundwater sampling protocols
- o chain-of-custody documentation and analytical laboratory results
- o discussion of results and recommendations